# REMARKS

Claims 29 to 35 were rejected as obvious under 35 U.S.C. § 103 (a) over Frederick, Jr. (US 3,880,028), in view of Tjaden (US 3,821,910) and Ohta (JP1994-102480).

## I. Independent Method Claim 29

The method claimed in claim 29 comprises the following steps:

a) providing a moving glass sheet that is continuously moving in a travel direction;

b) moving a cutting tool across the moving glass sheet at an angle to the travel direction of the moving glass sheet so that the cutting tool traverses different regions of the glass sheet with different glass sheet thicknesses;

c) during the moving of the cutting tool across the moving glass sheet over said different regions of said glass sheet, applying different cutting forces to the moving glass sheet in said different regions of the glass sheet so that a fissure is formed in the glass sheet;

d) measuring said inhomogeneous thickness distribution across the glass sheet to determine said different thicknesses in said different regions; and

e) during the moving of the cutting tool across the moving glass sheet to form said fissure, adjusting the different cutting forces applied to said moving glass sheet in said different regions according to said different thicknesses of said glass sheet in said different regions determined during said measuring of step d), so that said different cutting forces are increased when said different thicknesses increase and said different cutting forces are decreased when said different thicknesses decrease; and then

f) mechanically breaking the glass sheet along the fissure;

g) controlling said different cutting forces applied by said cutting tool in said different regions so that said different cutting forces are sufficient to form said fissure but not so large as to cause uncontrolled breaking of said glass sheet during formation of the fissure prior to the mechanically breaking.

Inhomogeneous thickness distributions occur during continuous manufacture of a glass sheet from a melt, especially in border regions of the glass sheet, and particularly in the float glass process (see page 2, 1$^{st}$ paragraph, of applicants' originally filed specification). The thickness variations across the continuously produced glass sheet are sufficiently large, especially for thin glass sheets (< 3 mm), so that a significant amount of waste due to uncontrollable breakage occurs in the methods of the prior art. One

purpose of the applicants' method is to reduce or eliminate the amount of glass pieces cut from the sheets that must be discarded due to uncontrolled breakage.

The applicants have provided some exemplary data for a continuously produced glass sheet of 8 cm width at 1 mm intervals across the glass sheet, which has not been filed in the USPTO. According to the data the glass sheet had a thickness of 4.0 ± 0.1 mm at the edges and 2.2 ± 0.1 mm at the center of the glass sheet. Thus if the sheet is scored with a constant depth of e.g. 2.2 mm across the entire sheet, uncontrollable breakage would surely occur. Even if a constant score depth of 1 mm is used in this exemplary situation uncontrollable breakage could occur if the force used by e.g. a breaking bar after scoring is too great in the central portion of the glass sheet.

The aforesaid example is provided to show that prior art methods in which a constant force is applied during scoring or the score is a constant depth across the entire glass sheet during scoring <u>could</u> produce significantly more breakage than a method that adjusts the scoring force or depth of the score in accordance with the thickness variations across the glass sheet. It will be shown herein below that the applicants' method is significantly better than

such prior art methods that rely on a constant applied force or that produce a score or fissure of constant depth, because the scoring or fissure-producing force applied during cross-cutting is varied in accordance with the thickness variations across the glass sheet according to steps c, d, e and g) of the method claimed in applicants' claim 29. Greater breaking force variations are tolerated.

The final Office Action mailed on September 16, 2010 and the prosecution history of the above-identified application effectively admit that Fredrick, Jr does <u>not</u> provide a basis for rejecting a method including steps c), d), e) and g) of applicants' claim 29 under 35 U.S.C. § 103 (a). The final Office Action explicitly states that Fredrick, Jr does not provide a basis for rejecting a method including steps c), d), e) and g) of applicants' claim 29 (page 4 of the instant Office Action).

<u>According page 4 of the final Office Action</u> Tjaden discloses a method of cutting a glass sheet including steps c, e and g of claim 29, in which the cutting force is increased when the thickness of the glass sheet increases and is decreased when the thickness of the glass sheet decreases, citing portions of columns 1, 3, and 4 of Tjaden. <u>Applicants respectfully disagree</u> with this opinion.

Tjaden teaches a special mechanism or device for producing a score or fissure in a glass sheet. Column 1, lines 25 to 30, do teach that the object of their invention is to provide a uniform score line which is “readily responsive to irregularities in the surface”. This statement means that the tip of the bottom of the scoring tool or wheel 94 (column 2, line 42) follows the variation in the height of the surface as the tool or wheel travels over the surface. The height variations would of course be due to a variation in the thickness of the glass plate or sheet, but this statement does not disclose or limit the amount of force that is applied to the glass sheet or the depth of the score line as the wheel or tool travels over it.

The disclosure in column 1 of Tjaden that the score line should be uniform suggests the opposite from applicants' claimed method: applicants' score line is <u>not</u> uniform in the sense that the method claimed in claim 29 does <u>not</u> produce a score line of constant depth -- the depth of the score line <u>varies</u> according to the method of claim 29, because the applied cutting force is varied according to step e of claim 29 (assuming that the composition and physical properties of the glass sheet are uniform across the glass sheet so that a constant applied force results in a constant depth of the score or fissure).

Furthermore, the **abstract of Tjaden** clearly states that their cutting mechanism is operated **so that a substantially constant force is applied** to score the glass sheet "regardless of variations in the glass thickness" (third and fourth lines of the abstract). This teaching is clearly the opposite from applicants' claimed invention according to step e of claim 29. **Step e of claim 29** (last four lines of step e) clearly **states** that **cutting forces are increased when glass sheet thickness increases and decreased when glass sheet thickness decreases**.

The foregoing teaching is clearly teaching of doing the opposite from the claimed invention. <u>A prior art reference that teaches the **opposite** from the claimed invention should not be combined with other prior art references</u> to reject the claimed invention under 35 U.S.C. § 103 (a). For example, the Federal Circuit Court of Appeals has said:

> **"That the inventor achieved the claimed invention by doing what those skilled in the art suggested should not be done is a fact strongly probative of nonobviousness."** in ***<u>Kloster Speedsteel AB v. Crucible Inc.,</u>*** 230 U.S.P.Q. 81 (Fed. Cir. 1986), on rehearing, 231 U.S.P.Q. 160 (Fed. Cir. 1986).

Thus, Tjaden clearly teaches away from the claimed invention according to claim 29, because Tjaden teaches that the force applied to cut the score line should be constant "regardless of

**variations** in glass thickness", but applicants teach that it should be increased when thickness increases and decreased when thickness decreases. Regarding the elements of "teaching away" the Federal Circuit has said (as quoted in *In re Kubin* 561 F.3d 1351 (Fed. Cir. 2009):

> **"A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant."** ***In re Gurley***, 27 F.3d 551, 553 (Fed. Cir. 1994).

Certainly a prior art reference that teaches that the force of the cutting tool during scoring should be constant as the cutting tool moves across the glass sheet discourages one skilled in the art from varying the cutting force to account for the thickness variations.

The mechanism claimed in the claims of Tjaden is clearly consistent with the description in their abstract. According to the last four lines of claim 1 of Tjaden the cutting tool "applies a substantially **constant force** [to the surface of the glass sheet] regardless of variations in the sheet thickness or irregularities in the glass surface" [the wording in the brackets of this quotation is our addition from the disclosures of Tjaden, which has been inserted for easy understanding, but otherwise the wording in quotation marks is

a direct quote from claim 1 of Tjaden]. However as noted above this is diametrically opposite to step e of applicants' claim 29!

Armature 60 and plates 62 and 64 of the mechanism of Tjaden are made of ferrous metal. When coil 44 is energized, the magnetic flux passes from the coil through plate 64 through the armature to annular member 48 and thence to the coil, thus completing the magnetic circuit, which constantly urges the quill assembly downwardly **with a uniform force** (see column 3, lines 11 to 16, of Tjaden).

The force exerted on the armature, quill assembly and cutting wheel is constant regardless of irregularities or thickness variations in the surface of the glass sheet, so that a uniform score line is obtained for cutting or breaking the glass along the score line (see column 3, lines 31 to 35, of Tjaden).

Tjaden very clearly discloses that a uniform force is supplied and that a uniform score line is obtained. According to the applicants' invention different cutting forces are applied and the cutting forces are increased when the thicknesses increase and the cutting forces are decreased when the thicknesses decrease (step e), claim 29). These different forces result in a non-uniform score

line, because in the thicker regions the score line has a greater depth.

Tjaden maintains a constant cutting force on the glass sheet even if there are "variations in the surface of the glass" by a "movement in the quill assembly". These quotes from column 3, lines 48 to 62, show that the cutting force is always constant and independent of the thickness of the glass.

Applicants' respectfully disagree with the opinion expressed in the Office Action regarding the disclosures in column 3, line 67, to column 4, line 3. This paragraph states that thicker sheets of glass may require greater cutting force to produce a score line than in the case of thinner sheets. Applicants agree but the aforesaid statement in Tjaden merely means that, when breaking a glass sheet **of a certain nominal or average thickness,** the score line must be sufficiently deep, so that the sheet can be easily broken by applying the breaking force with e.g. a breaking bar. This statement in the paragraph bridging columns 3 and 4 of Tjaden does **not** state that the cutting force applied during travel of the cutting tool across the glass sheet should be varied according to the thickness variations across the glass sheet. Furthermore, attention is called to the last four lines of this paragraph in Tjaden quoted herein below:

"The selected degree or level of ***force applied***, however, is

**maintained *constant* throughout the operation regardless of slight and unintentional variations in glass thickness and surface irregularities."**

Thus Tjaden **consistently** teaches applying a **constant** cutting force during cross-cutting of a glass sheet or during scoring of a glass plate -- regardless of thickness variations. This is diametrically opposite to the claimed method according to claim 29.

Ohta is cited for disclosing step d of claim 29, namely measuring the thickness variations across the glass sheet to determine different thicknesses in different regions of the glass sheet. A legible, understandable English translation of the Japanese Patent Document of Ohta has been provided with this request for reconsideration for consideration during examination.

Ohta does disclose measurement of different thicknesses in different regions of the glass sheet with the thickness sensor 4 (see the paragraphs marked "object", "constitution" on page 2 and paragraphs [0022] and [0023] on page 5 of the English translation).

Although Ohta does essentially disclose step d of claim 29, since Tjaden does **not** disclose or suggest steps c, e and g of claim 29, which is shown by the above argumentation, whether or not Ohta discloses any of steps c, e and g of claim 29 is considered in the

following paragraphs of these REMARKS.

According to the English abstract provided by the U.S. Patent Office the scribing depth is a constant as the cutter 1 moves across the glass sheet (last line of this abstract). Thus the English abstract teaches a method that is no different from that of Tjaden. The depth of the score line is kept constant regardless of any thickness variations.

The English translation obtained by the applicants confirms that the cutting force on the glass sheet is selected regardless of the thickness variations so that the depth of the score is <u>uniform</u>, i.e. **constant**, across the sheet (see paragraphs [constitution], [0019] and [0023] of Ohta). This is the opposite of applicants' claimed method because applicants apply a greater cutting force to the glass sheet to make a deeper score when the thickness is greater and a lesser cutting force to make a more shallow score when the thickness is smaller.

Thus neither secondary prior art reference teaches or suggests that the cutting force is adjusted during cutting according to the thickness variations across the glass sheet so that the cutting force is greater in regions in which the glass sheet is thicker and is

smaller in regions in which the glass sheet is thinner. The result is a non-uniform depth of score in contrast to the uniform depth scores of Ohta and Tjaden.

According to one rationale for an obvious rejection that has not been abolished by the KSR Supreme Court decision (see M.P.E.P. 2143) there must be some hint or suggestion in the prior art of the modifications of the disclosure in a prior art reference or references used to reject the claimed invention, which are necessary to arrive at the claimed invention. For example, the Court of Appeals for the Federal Circuit has said:

> **"Rather, to establish obviousness based on a combination of elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant...Even when obviousness is based on as single reference there must be a showing of a suggestion of motivation to modify the teachings of that reference.."** ***In re Kotzab***, 55 U.S.P.Q. 2nd 1313 (Fed. Cir. 2000). See also M.P.E.P. 2141

In the case of the present method as claimed by claim 29 the secondary references do not disclose or suggest the critical modifications of the disclosures in the primary reference Fredrick, Jr, which are necessary to arrive at the invention as claimed in claim 29. They do not suggest the features of steps c, e and g of claim 29.

Furthermore there is no evidence or prior art that has been presented to suggest that adjusting the cutting force according to the thickness variations is a known technique that has been disclosed in the prior art prior to the applicants' date of invention. Accordingly the method claimed in claim 29 is not *prima facie* obvious under the newer rationale suggested by the *KSR* Supreme Court decision (again see M.P.E.P. 2143).

**II. Independent Method Claim 34**

Independent method claim 34 was also rejected for the same reasons as claim 29 and it is respectfully submitted that a case of *prima facie* obviousness of claim 34 has also not been established for the above reasons regarding claim 29.

The method of claim 34 comprises the following steps:

a) providing a moving glass sheet that is continuously moving in a travel direction;

b) moving a cutting tool across the moving glass sheet at an angle to the travel direction of the moving glass sheet so that the cutting tool traverses a plurality of positions on the glass sheet;

c) during the moving of the cutting tool across the moving glass sheet, continuously measuring respective glass sheet thickness values of the moving glass sheet;

d) during the moving of the cutting tool across the moving glass sheet, applying variable cutting forces to the moving glass sheet at corresponding points of contact of the cutting tool with the glass sheet so that a fissure is formed in the glass sheet;

e) mechanically breaking the glass sheet along the fissure; and

f) automatically controlling said variable cutting forces applied by the cutting tool at said corresponding points of contact of the cutting tool with the moving glass sheet so that said variable cutting forces vary according to said respective glass sheet thickness values at said points of contact and are sufficient to form said fissure but not so large as to cause uncontrolled breaking of said glass sheet during formation of the fissure prior to the mechanically breaking.

According to page 6 of the final Office Action Fredrick, Jr does not teach a method comprising the features of steps c, e, and g of claim 29 that are present in claim 34. The secondary reference, Tjaden, is cited for teaching these features, which appear to be in steps d and f of claim 34. According to step d of claim 34 <u>**variable**</u>

cutting forces are applied at points of contact of the cutting tool on the glass sheet. According to step f of claim 34 the **variable** cutting forces **vary according to the respective thickness values** at the points of contact. The connection between step f and step d of claim 34 is provided by step c which requires the thickness values to be measured continuously as the cutting tool moves across the glass sheet.

As noted above in section I, the abstract and the remainder of the specification of Tjaden clearly teach that a **constant** force is applied to the surface of the glass sheet during motion of the cutting tool over the glass sheet to make the scribe line (line 3 of the abstract). The last four lines of the written description of Tjaden are, as noted above:

> **"The selected degree or level of *force applied*, however, is maintained *constant* throughout the operation regardless of slight and unintentional variations in glass thickness and surface irregularities."**

Thus Tjaden **consistently** teaches the **opposite** from the claimed invention according to claim 34. Tjaden requires application of a constant force for scribing regardless of the thickness variations across the glass sheet. Applicants teach increasing the cutting force where the glass sheet is thicker and decreasing the cutting force where the glass sheet is thinner.

The same comments regarding the disclosures of Ohta can be made on the basis of the English abstract provided by the U.S. Patent Office and on the basis of the English translation of Ohta's JP patent document that were made in the above section I are applicable here to claim 34.

The English translation of Ohta obtained by the applicants confirms that the cutting force on the glass sheet is selected regardless of the thickness variations so that the depth of the score is uniform, i.e. **constant**, across the sheet (see paragraphs [constitution], [0019] and [0023] of Ohta). This is the opposite of applicants' claimed method because applicants' apply a greater cutting force to the glass sheet to make a deeper score when the thickness is greater and a lesser cutting force to make a more shallow score when the thickness is smaller.

Thus neither secondary prior art reference teaches or suggests that the cutting force is adjusted during cutting according to the thickness variations across the glass sheet so that the cutting force is greater in regions in which the glass sheet is thicker and is smaller in regions in which the glass sheet is thinner. The result is a non-uniform depth of score in contrast to the uniform depth scores

of Ohta and Tjaden.

Accordingly the combination of Fredrick, Jr with the secondary references Tjaden and Ohta does not establish a case of *prima facie* obviousness of independent method claim 34.

For the aforesaid reasons withdrawal of the rejection of claims 29 to 35 as obvious under 35 U.S.C. § 103 (a) over Frederick, Jr. (US 3,880,028), in view of Tjaden (US 3,821,910) and Ohta (JP1994-102480) is respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims and/or drawing be further amended or corrected in formal respects to put this case in condition for final allowance, then it is requested that such amendments or corrections be carried out by Examiner's Amendment and the case passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing the case to allowance the Examiner is invited to telephone the undersigned at 1-631-549-4700.

In view of the foregoing, favorable allowance is respectfully solicited.

Respectfully submitted,

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## SCRIBING DEVICE


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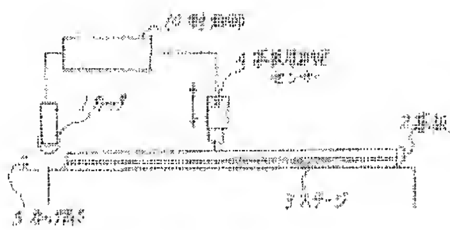
Abstract of **JP 6102480 (A)**

PURPOSE:To scribe without being affected by the dispersion in the thickness of a substrate by measuring the substrate thickness, automatically setting a cutter height corresponding to the measured value and always setting the cutter height to an optimum value. CONSTITUTION:This device is a scribing device provided with a substrate thickness measuring sensor 4 and a control part 10. and drawing a scribing line for cutting on the substrate 2 on a stage using a cutter, and by the substrate thickness measuring sensor 4, the thickness of the substrate 2 on the stage is measured, and by the control part 10, a distance from the stage 3 to the edge of the cutter is adjusted corresponding to the substrate thickness.; Then, before the substrate 2 is scribed by the cutter 1, the substrate thickness measuring sensor 4 is abuttd on the substrate at the central part of the substrate, and the substrate thickness is measured. The height 5 of the cutter 1 is adjusted by the control part 10 corresponding to the measured value, and scribing is started. Thus, the cutter height 5 is set to the optimum value always corresponding to the dispersion in the thickness of the substrate, and the depth of cutting by the scribing becomes constant.

TRANSLATION

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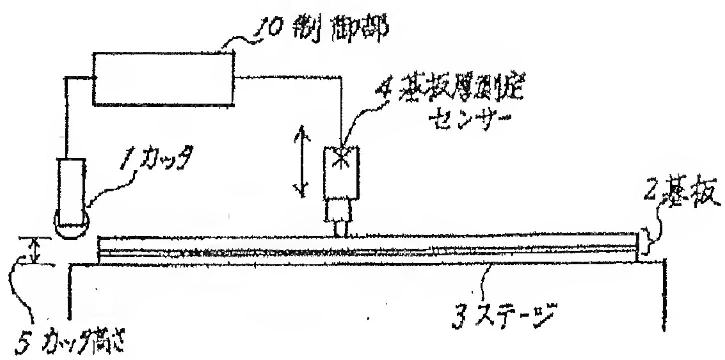
(54) **[Title of the Invention]** SCRIBING DEVICE

(57) **[Abstract]**

**[Object]** To prevent defects from occurring during breaking, by means of scribing which is not influenced by variations in substrate thickness when cutting a glass substrate.

**[Constitution]** Measuring substrate thickness with substrate thickness measuring sensor **4** before scribing, and after cutter height **5** is automatically adjusted in accordance with the obtained measured value, scribing is initiated. Accordingly, the incision depth due to scribing is uniform, without depending on variations in substrate thickness, and the occurrence of defects during breaking can be reduced.




**[Claims of the Invention]**

**[Claim 1]** Scribing device having a substrate thickness measuring sensor and a control unit, and which draws a scribing line for cutting on an insulating substrate on a stage using a cutter, said scribing device characterized in that the substrate thickness measuring sensor measures the thickness of the insulating substrate on the stage, and the control unit adjusts the distance from the stage to the edge of the cutter blade according to the thickness of the substrate.

**[Detailed Description of the Invention]**

**[0001]**

**[Industrial Field of Use]** The present invention relates to a scribing device for cutting an insulating substrate.

[0002]

**[Prior Art]** In the manufacture of liquid crystal display elements, there are cases in which only one surface of a glass substrate, formed from two sheets which are laminated together, is cut, as in a prior art method illustrated in **FIG. 3**.

**[0003]** As shown in **FIG. 3 (a)**, first, an incision **6** is made along a cutting line on a glass substrate, by scribing with super-hard or diamond cutter **1** of a scribing device.

**[0004]** Next, as shown in **FIG. 3 (b)**, the incision **6** is placed facing down, on a table of a breaking device, and a squeegee **7** is lowered, applying an impact on a portion on the opposite side of the of the incision **6** on the glass substrate. Accordingly, the glass substrate is caused to break, using the incision **6** as a point of origin, making it possible to cut only one surface.

**[0005]**

**[Problems to be Solved by the Invention]** In the prior art method, the depth of the incision **6** due to scribing is important, in order to break in good yield. If the incision **6** is too shallow, it is impossible to break with the breaking device, and if the incision **6** is too deep, chipping (minute cracks) occurs along the incision **6**, and abnormal breaking (not breaking along the cutting line) occurs during breaking.

**[0006]** **FIG. 4** shows breaking states according to the scribing conditions. The graph shows that the depth of the incision depends on the pushing pressure **9** of the cutter **1** on a substrate **2**, and if the pressure is low, then it becomes shallow and breaking is impossible, and if the pressure is high, then it becomes deep and chipping readily occurs.

**[0007]** It also depends on the on the thickness of the substrate, and if the substrate is thin, then the incision is shallow, and if the substrate is thick, then the incision is deep, with respect to the cutter height setting **8** (the distance from the upper surface of the stage to the edge of the cutter.)

**[0008]** Here, in **FIG. 4**, when the cutter pushing pressure 9 is 1.0 $kg/cm^2$, the conditions are such that the widest margin is obtained (± 0.08 mm with respect to the cutter height setting) with respect to variations in substrate thickness.

**[0009]** However, as shown in **FIG. 5**, a glass substrate used in a liquid crystal display element can have a variation in thickness in a range of about ± 0.1 mm (2.04 mm – 2.24 mm) for each substrate laminated together.

**[0010]** Since this exceeds the range of breakability, breaking will either definitely be impossible, or substrates will occur with abnormal breaking and defects.

**[0011]** Based on the data of **FIG. 5**, typically, the cutter height is set at 2.16 mm, and the range of breakability is 2.08 mm – 2.24 mm. Thus, about 3% of substrates of thickness less than 2.08 mm occur as unbreakable and defective.

**[0012]** The present invention has as its object to provide a scribing device which makes scribing possible, without being influenced by variations in substrate thickness.

**[0013]**

**[Means for Solving These Problems]** In order to achieve the above object, the scribing device of the present invention has a substrate thickness measuring sensor and a control unit, and which draws a scribing line for cutting on an insulating substrate on a stage using a cutter, said scribing device characterized in that the substrate thickness measuring sensor measures the thickness of the insulating substrate on the stage, and the control unit adjusts the distance from the stage to the edge of the cutter blade according to the thickness of the substrate.

**[0014]**

**[Operation]** The thickness of the substrate is measured before scribing, and the cutter height (the distance from the upper surface of the stage to the edge of the cutter) is automatically adjusted according to the measured value which was obtained.

**[0015]**

**[Embodiments]** Embodiments of the present invention are described below with reference to drawings.

**[0016]** *Embodiment 1* **FIG. 1** is a schematic drawing illustrating Embodiment 1 of the present invention.

**[0017]** In **FIG. 1**, the present invention has a substrate thickness measuring sensor **4** installed on a stage **3** for measuring the thickness of the substrate **2**, and is also equipped with a control unit **10** for adjusting the height **5** of the cutter **1** in accordance with the measured value obtained from the sensor **4**.

**[0018]** Before scribing the substrate **2** with the cutter **1**, substrate thickness measuring is

carried out by abutting the substrate thickness measuring sensor **4** against the substrate at the center of the substrate. The height **5** of the cutter **1** is adjusted by the control unit **10** in accordance with the measured value, and scribing is initiated.

**[0019]** Accordingly, it is possible to set the cutter height **5** to a typical optimal value in response to variations in substrate thickness, resulting in a uniform incision due to the scribing.

**[0020]** ***Embodiment 2*** **FIG. 2** is a schematic drawing illustrating Embodiment 2 of the present invention.

**[0021]** In Embodiment 1 above, the measurement position is at a single site, and since the thickness of the cntire substrate is represented by this one site, there is a large error with respect to the variations in thickness over the entire substrate surface.

**[0022]** In Embodiment 2, the substrate thickness measuring sensor **4** is in front, and the cutter **1** is in back, and they are caused to run synchronously along the scribing line, so that the measured values of substrate thickness sequentially feed back to the control unit **10**, to automatically adjust the cutter height **5**.

**[0023]** Accordingly, the cutter height **5** can be set at an optimal value for all scribing sites, with the advantages that the incision depth is uniform, and breaking defects can be reduced.

**[0024]**

**[Advantageous Effects of the Invention]** Since the present invention described above carries out substrate thickness measurement, and the cutter height is automatically adjusted according to the measured values obtained, the cutter height is always set at the optimal value, and the incision depth resulting from scribing is uniform. Consequently, the defect rate during breaking can be reduced from 3% to 1%.

**[Brief Description of the Drawings]**

**[FIG. 1]** Schematic drawing illustrating Embodiment 1 of the present invention.
**[FIG. 2]** Schematic drawing illustrating Embodiment 2 of the present invention.
**[FIG. 3]** **(a)** and **(b)** are schematic drawings illustrating a prior art scribing/breaking method.
**[FIG. 4]** Graph showing breaking states according to the scribing conditions.
**[FIG. 5]** Graph showing the distribution of thickness for each substrate.

## [Explanation of the Reference Numerals]

- **1** Cutter
- **2** Substrate
- **3** Stage
- **4** Substrate thickness measuring sensor
- **5** Cutter height
- **6** Incision
- **7** Squeegee
- **8** Cutter height setting
- **9** Cutter pushing pressure

FIG. 1

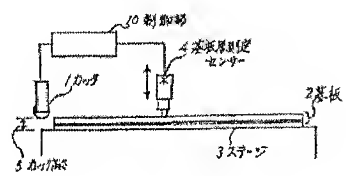
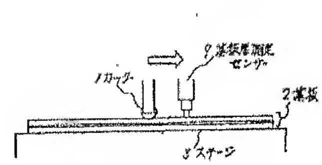


FIG. 3



1 Cutter; 2 Substrate; 3 Stage; 4 Substrate thickness measuring sensor; 9 (*sic*) Substrate thickness measuring sensor; 5 Cutter height; 10 Control unit

FIG. 3

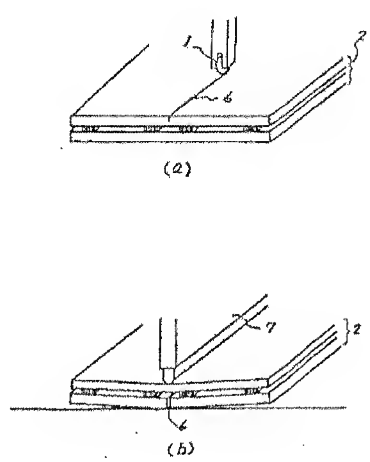
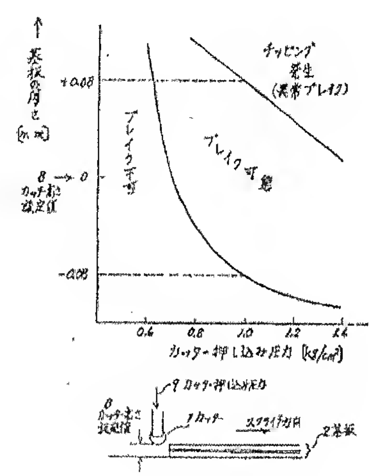


FIG. 4



1 Cutter; 2 Substrate; 8 Cutter height setting; 9 Cutter pushing pressure

FIG. 5

Distribution of thickness for each substrate